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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
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09/638,026 08/14/00 FARRAR

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EXAMINER

MM91/0928

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WASHINGTON DC 20037-1526

FAREKH, N
ART UNIT

PAPER NUMBER

2811
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09/28/01

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary

Application No.
09/638,026

Applicant(s)
Farrar

Examiner
Nitin Parekh

Art Unit
2811



— The MAILING DATE of this communication appears on the cover sheet with the correspondence address —

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on Jun 14, 2000
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 35 C.D. 11; 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 40-51 and 68-73 is/are pending in the application.
- 4a) Of the above, claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 40-51 and 68-73 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claims _____ are subject to restriction and/or election requirements.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are objected to by the Examiner.
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

- 13) ☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).
- a) ☐ All b) ☐ Some* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- *See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

- 15) ☒ Notice of References Cited (PTO-892) 18) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 16) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 19) ☐ Notice of Informal Patent Application (PTO-152)
- 17) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s). _____ 20) ☐ Other: _____

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 40-51, 68-70 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yamamoto (US Pat. 5925931) in view of Akram (US Pat. 5808360) and the admitted prior art (APA).

Regarding claims 40, 45-51, Yamamoto discloses a semiconductor device comprising:

- a semiconductor structure having a metal contact (23 in Fig. 7) formed on the surface thereof
- a first insulator layer (24/41 in Fig. 7) overlying the metal contact
- a metal pad/interconnection (50 in Fig. 7) overlying the first insulator layer and in contact with the metal contact, the metal pad being partially overtop of the metal contact
- a second insulator layer (47 in Fig. 7) overlying the metal pad
- the metal contact being connected to the metal pad by a via hole (25/42 in Fig. 7) in the first insulator, and

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- Solder contact/ball (48 in Fig. 7) formed in the second insulator layer and in contact with the metal pad, the solder contact/ball extending from the top of the second insulator layer to the metal pad by a through-hole formed in the second insulator (Fig. 7)

(Fig. 7; Col. 6, line 40- Col. 7, line 5; Col. 4-8).

Yamamoto fails to specify the diameter of the solder contact/ball being less than 100 microns.

The APA discloses using conventional 100 microns diameter solder balls in C4 bonding of an integrated circuit/wafer to a substrate such as module or circuit board.

Akram teaches using solder microbumps having a diameter ranging from 15-100 microns (30 in Fig. 1C; Col. 5, line 7- 32) in a flip chip interconnection.

Therefore, it would have been obvious to a person of ordinary skill in the art at the time invention was made to incorporate solder contacts having diameter less than 100 microns to achieve the desired connection density and performance using Akram's microbump configuration in Yamamoto's device.

Regarding claims 41-44, as explained above, Yamamoto in view of Akram teaches using solder contacts/balls having a diameter ranging from 15-100 microns but fails to specify the diameter of the solder contact/ball being less than 10 microns or approximately 2 microns.

The selection of parameters such as size and shape of the solder contacts including diameter, pitch/spacing, pad dimension, thickness of an insulating layer, etc. in chip packaging and interconnection technology art is a matter of design choice to achieve the desired I/O density, performance and reliability. Therefore, it would have been obvious to a person of ordinary skill in the art at the time invention was made to select the solder contacts having diameter less than 50, 25, 10 or approximately 2 microns to achieve the desired connection density and performance using Akram's microbump configuration in Yamamoto's device.

Regarding claim 68, Yamamoto discloses the first insulating layer being 10-50 microns thick (Col. 4, line 39) but fails to specify the first insulating layer being 2 microns thicker than the metal contact. However, it can be clearly seen in Fig. 7 of Yamamoto's device that the first insulating layer (41/24 in Fig. 7; Col. 4, line 39)) is 2-3 times thicker than the metal pad which is conventionally approximately 10 microns thick (see Akram, Col. 4, line 18). Therefore, it would have been obvious to a person of ordinary skill in the art at the time invention was made to incorporate the first insulating layer being 2 microns thicker than the metal contact to achieve desired degree of protection/passivation in Yamamoto's device in view of Akram and APA.

Regarding claims 69 and 70, Yamamoto further discloses the metal pad/interconnection comprising a stack of four different metals comprising Zinc, Nickel, Copper, Gold (43/44/45/46A/46B/50 in Fig. 7; Col. 5, line 9-35) but fails to specify using Zirconium as

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one of the four metals. It is conventional in the chip packaging and interconnection technology art to use metals such as Nickel, Copper, Gold, Zirconium, Palladium, etc. in forming metal pad/interconnection. Therefore, it would have been obvious to a person of ordinary skill in the art at the time invention was made to incorporate the metal pad comprising a stack of four different metal levels comprising Zirconium, Nickel, Copper and Gold to achieve the desired electrical properties passivation in Yamamoto's device in view of Akram and APA.

3. Claims 71 and 72 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yamamoto (US Pat. 5925931) in view of Akram (US Pat. 5808360) and the admitted prior art (APA).

The combined teachings of Akram and APA apply to Yamamoto for claims 71 and 72 as explained above for claims 40-44.

4. Claim 73 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yamamoto (US Pat. 5925931) in view of Akram (US Pat. 5808360) and the admitted prior art (APA).

Applicant's claim 73 do not distinguish over Yamamoto in view of Akram and the admitted prior art (APA) regardless of the process used to form the solder contacts/bumps, because only the final product is relevant, not the process of making

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claim is directed to the product per se, no matter how actually made, *In re Hirao*, 190 USPQ 15 at 17 (footnote 3). See also *In re Brown*, 173 USPQ 685; *In re Luck*, 177 USPQ 523; *In re Fessmann*, 180 USPQ 324; *In re Avery*, 186 USPQ 161; *In re Wertheim*, 191 USPQ 90 (209 USPQ 554 does not deal with this issue); and *In re Marrosi et al.*, 218 USPQ 289, all of which make it clear that it is the patentability of the final product per se which must be determined in a "product by process" claim, and not the patentability of the process, and that an old or obvious product produced by a new method is not patentable as a product, whether claimed in "product by process" claims or not. Note that applicant has the burden of proof in such cases, as the above case law makes clear. See also MPEP 706.03(e).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nitin Parekh whose telephone number is 703-305-3410. The examiner can normally be reached on 09:00AM-05:30PM.


If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on 703-308-2772. The fax phone numbers for the organization where this application or proceeding is assigned are 703-308-7722 for regular communications and 703-308-7722 for After Final communications.

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Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-306-3431.

Nitin Parekh

NP
September 26, 2001


TOM THOMAS
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800